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Abstract

There is a definite focus in Information Systems (IS) research that is based around the identification of variables that measure the factors that influence IS success in small business. Identification of measures is of importance to the individuals running those businesses as well as researchers seeking to enunciate the value of IS. The first step in this process is to develop models of interacting factors that contribute to success. DeLone and McLean (1992) identified six inter-related factors that help to account for success of IS in small business. Their model has served as a platform for other researchers in this area (e.g., Seddon & Kiew, 1996; Thong & Yap, 1995). A second important step in this process is the identification of antecedent factors and core constructs that predict the success of IS. Without such instruments, it is not possible to go beyond mere speculation about possible contributors to small business IS success. In this paper the authors report on the factorial validation of an instrument that can be used to access core constructs that measure CEO characteristics, organisation characteristics and decision-making related to IS. They also provide a descriptive analysis of these scales to illustrate their relationships with each other and the core demographic items from the survey. Later analyses will examine these constructs as predictors of the constructs measuring IS success using structural equation modelling.

Keywords

CEO Characteristics, Decision Making, Information System Success, Organisation Characteristics, Small Business

Introduction

We live in an age where computer technology is an indispensable part of all businesses, large or small, rural or urban. Computers are used to improve stock control, to improve office efficiency, to assist in strategic planning, and to open communication channels to the outside world. Software packages include word processing, spreadsheets, desktop publishing, and a wide variety of accounting programs. The computer systems themselves range from simple, home office systems offering a limited range of applications, to complicated mainframes feeding networks across multiple sites and offering a comprehensive array of applications. To complete the profile of what is really a diverse technological business landscape, the owners and decision makers in these businesses are themselves remarkably diverse in terms of computer knowledge and skills.

Despite the optimism underlying the technological developments outlined in our opening paragraph, the reality is that many businesses, especially small businesses, do not capitalise on the opportunities offered by computerisation. In fact, investment in computerisation is often a contributing cause for small business failure, especially in regional areas of Australia. To gain a clearer picture of the reasons for small business investment in computers and the factors that contribute to a successful conversion to computerisation, a survey of small businesses throughout the North Eastern area of NSW was conducted. The aim was to gather background information on such areas as the types of business applications for which the business owners required computer support (e.g., accounting), the characteristics of the organisation (e.g., whether it was in a growth phase), the decision making processes that led to computerisation or partial computerisation of the business, the characteristics of the chief executive officers of the business (e.g., computer literate versus non-computer literate), and whether or not cost-benefit models were used to support purchase decisions.

A secondary aim of the study was therefore to develop and validate a questionnaire that can be used by other researchers and small businesses themselves to identify factors relevant to successful computerisation. We begin by describing those parts of the questionnaire of relevance to the present study and then tracing the development of subscales through traditional psychometric techniques such as factor analysis and internal consistency reliability analysis. We then present descriptive data for the various subscales showing how the 171 small businesses that participated in the study rated themselves on the various dimensions captured by the survey.

Methodology and Data Collection

The questionnaire included many of the items used by Thong and Yap (1995), but the items were recast in general terms, rather than targeting a particular software package, as was the case in their study. The construct validity of the items measuring Computer Based Information System (CBIS) success have been published previously (Armstrong et al, 2005; Fogarty et al, 2003) and are not discussed further in this paper.

Following the guidelines set out for questionnaire validation by Comrey and Lee (1992) and Gorsuch (1983), the main analytical tool was exploratory factor analysis (EFA). EFA is a technique that can be used to reduce a large dataset to a smaller number of underlying explanatory constructs. There are various methods of EFA, some of which seek to explain the total variance in the dataset (principal components), whilst other techniques (common factor analysis) target only the shared variance, excluding variance unique to each variable. Because our interest was primarily in the underlying structure of the User Information Satisfaction (UIS) survey, we used common factor analytic techniques (Gorsuch, 1983). Our expectation was that groups of items included in our survey instrument would define separate factors and that these factors would correspond with the constructs purportedly measured by the UIS. Other items were expected to define constructs introduced in the present study. Evidence of factorial validity provides empirical justification for forming scales based on the factors and for using those scales in applied settings. Other methodological details relating to the factor analyses will be explained in the Results section.

Internal consistency reliability analysis (coefficient alpha) was employed as a supplementary tool to refine the scales. Whereas factor analysis is useful for identifying those items that properly belong to a scale, reliability analysis is helpful for determining how many items are needed to measure a construct. For example, whilst EFA might indicate that all 10 items selected to represent a particular construct load on the relevant dimension, subsequent internal consistency reliability analysis may indicate that fewer than 10 items are actually needed for reliable measurement of this construct. Used together in the proper manner, factor analysis and reliability analysis are powerful tools for validating and refining scales.

The sampling procedure and questionnaire construction have been covered in detail in previous papers (Armstrong et al, 2005; Fogarty et al, 2003) so is briefly summarised in the following sections. Table 1 was re-produced from these papers to illustrate the sample distribution and highlight the representativeness of the sample. We then proceed to the factor analysis of the questionnaire and the descriptive statistics for the various scales. This allows the reader to see how scores were distributed for this sample and to see the relations among the scales.

A trial version of the revised instrument was tested on a group of local businesses who gave feedback on the intelligibility of the questions, suitability of question format, method of administration, and so forth. Minor changes were introduced as a consequence of this pilot testing process.

The study targeted small wholesaling and manufacturing businesses on the Mid North Coast Region of New South Wales. They were selected from the Business Enterprise Register (BER), a database of over 13,500 businesses in the region. The Australian Bureau of Statistics (ABS) definition of small business (1995) was adopted for this study. This definition describes small manufacturing businesses as having fewer than 100 employees and small wholesaling businesses as having fewer than 20 employees. Suitable businesses were selected by listing all wholesalers and manufacturers that fell within the definition of 'small' as per the ABS. Table 1 shows the distribution of the small manufacturers and wholesalers that responded to the survey and the distribution of all manufacturers and wholesalers across the region.

Table 1: Distributions of Sample Population of Wholesalers and Manufacturers by Region and Sub Regions

		Manufacturers		Wholesalers		Manufacturers / Wholesalers		Region's Totals	
		Sample	All	Sample	All	Sample	All	Sample	All
Coffs Harbour	(n)	117	239	58	68	8	12	183	319
	(MNC)	19.6%	21.8%	9.7%	6.2%	1.3%	1.2%	30.6%	29.2%
	(SR)	63.9%	74.9%	31.7%	21.3%	4.4%	3.8%		
Hastings	(n)	147	276	75	141	3	11	225	428
	(MNC)	24.6%	25.1%	12.5%	12.9%	0.5%	1%	37.6%	39.0%
	(SR)	65.3%	64.5%	33.3%	32.9%	1.3%	2.6%		
Manning / Gloucester	(n)	72	150	66	131	16	23	154	304
	(MNC)	12.0%	13.7%	11.1%	12%	2.7%	2.1%	25.8%	27.8%
	(SR)	46.8%	49.3%	42.9%	43.1%	10.4%	7.6%		
Macleay	(n)	24	30	12	14			36	44
	(MNC)	4.0%	2.7%	2.0%	1.3%			6.0%	4.0%
	(SR)	66.7%	68.2%	33.3%	31.8%				
Region's Totals		360	695	211	354	27	46	598	1095
		60.2%	63.4%	35.3%	32.4%	4.5%	4.2%		

(n) - number of wholesalers and/or manufacturers
(MNC) - percentage distribution by industry type within the Mid North Coast region
(SR) - percentage distribution by industry type within the sub-region

Businesses that indicated their willingness to participate and used a CBIS were each mailed a survey package. A total of 240 businesses from the 598 selected from the database were sent survey packages. From these businesses, 171 surveys were returned.

Description of Factor Analytic Outcomes

Factor analysis of the questionnaire was undertaken section-by-section to maintain a favourable cases-to-variables ratio. A favourable ratio is at least five cases per variable (Tabachnick & Fidell, 1997). If the whole questionnaire had been included in the factor analysis an unfavourable cases-to-variables ratio would have resulted, given the number of items. It is recognised that factor analysing the questionnaire one section at a time leaves the issue unresolved of whether items selected to represent one construct might cross-load on another. Nevertheless, this jigsaw method helped to establish the dimensionality of groups of items, an important aspect of the construct validation process and an important precursor to testing various structural models.

Factor solutions were sought for the following sections of the questionnaire:

- *CBIS Importance* (Section 2: 15 items)
- *Decision Criteria* (Section 4.1: 24 items)
- *Decision Making* (Section 4.11: 12 items)
- *Organisation*al *Characteristics* (Section 5: 17 items)
- *CEO Characteristics* (Section 6: 12 items)

The MSA (0.78) and Bartlett's test of sphericity ($x^2[78] = 703.11$, $p < .001$) on the correlation matrix for all the sets of items showed that they were suitable for factor analysis.

Factor analysis of items related to *Decision Criteria* resulted in a number of smaller, not very significant, factors. The initial solution resulted in six factors being extracted. The six factors accounted for over 63% of the variance in the items. In this initial factor solution, the item "*Installation Support*" loaded on factors one and four, the item "*Pre-purchase information and support from the vendor*" loaded on factors five and six, and the item "*Advice from family members*" loaded on factors two and six. Each of these items had low to very low loadings on each of their respective factors. This low score makes interpretation of robust scales from the initial factor solution extremely difficult due both to poor factor definition and the low loadings of the items extracted for a number of the factors. A number of distinct "elbows" were evident in the scree plot. Hambleton et al. (1991) argued that when the first factor has an Eigen value that is three to four times the size of the Eigen value for the second factor, a uni-dimensional solution is justified as was the case with the factors derived for the items measuring *Decision Criteria*. The ratio of the Eigen values coupled with the difficulty of interpreting some of the factors in the root one solution, and the small number of items associated with some factors, was sufficient reason to adopt a one factor solution for the *Decision Criteria* items. While this solution predictably produces a set of loadings on the single forced factor, the last two items did not load on the factor at an acceptable level (>0.30).

Treating *Decision Criteria* as a uni-dimensional construct may mask the possibility that there are recognisable clusters of variables that count in the decision process (i.e., that it is really a multi-dimensional construct). However, the evidence presented here suggests that these dimensions have not been identified clearly in the study. The respondents to this survey acted as though most of the criteria captured by the individual items played a part in their decision criteria. The presence of a general factor accounting for 61% of the variance leads to this conclusion. In the analyses that follow, CBIS *Decision Criteria* are treated as a single construct, indicating the number of criteria consulted by purchasers. It is probably most accurately described as a measure of thoroughness in researching purchases and could be referred to as pre-purchase research. Treating the construct as uni-dimensional does not have any impact on its role in the conceptual model: Thoroughness of pre-purchase research should still predict user satisfaction and CBIS Success.

A single factor solution was also derived for Cost Benefit Analysis Techniques. It was not necessary to 'force' a single factor solution as described above and the single factor in the factor solution accounted for 64.4% of the variance in the item set. In the analyses that follow, *Cost Benefit Analysis Techniques* was treated as a single construct.

Factor Solution Summary

The factor validation process and detailed outcomes have been described previously (Armstrong et al, 2005; Fogarty et al, 2003) and are therefore only summarised below. The factor validation process resulted in 16 factors being identified for further analysis. A summary of the factors and the amount of variance explained by each is set down in Table 2.

Each of the factors met the base criteria for retention:

- items defining the various factors all had communalities greater than 0.25 (that is 25% or more of their variance is explained by the underlying factors);
- extracted factors accounted for greater than 50% of the variance in their sets of items (Fornell and Larker, 1981);
- all factors had eigen-values greater than 1.0 (Loehlin et al. 1987);
- all item loadings were greater than 0.30 (Tabachnik and Fidell, 1996);
- all factors are clearly interpretable (Gorsuch, 1983).

Having determined the factor structure of the survey, scales were formed from the various sets of items defining each of the factors. The psychometric properties of the derived scales are examined in the next stages of the analysis.

Table 2: Factor Solutions Summary

Factor Set	Factor Name	% of Variance Explained by Factor	Total Variance Explained
CBIS Importance	Importance of Accounts	30.70	
	Importance of SOHO	16.16	
	Importance of Management Applications	10.68	57.54
Decision Criteria	Decision Criteria	61.16	61.16
Decision Making	Operational Reasons	44.79	
	Strategic Reasons	17.04	61.83
Organisation Characteristics	Organisation Technical Capacity	44.59	
	Competitiveness	14.75	
	Expansion & Growth	11.35	70.69
CEO Characteristics	CEO CBIS Knowledge	58.64	
	CEO Innovativeness	25.18	83.82
Cost Benefit Analysis Techniques	Cost Benefit Techniques	64.41	64.41

Descriptive Statistics for Derived Scales

The reliability estimates of the scales formed from items identified through the factor analysis were examined using the Cronbach Alpha as a test of internal consistency. Internal reliability is particularly important when using instruments with multiple item scales such as the survey instrument used in this research.

Wright and Fowler (1986, p. 129; Hine, 1997, p. 212) deem the Cronbach Alpha (α), a measure of internal consistency, as the most popular technique used to estimate reliability. They suggested that a benchmark value of 0.8 should be used to judge the adequacy of the scale (p. 136). Nunnally and Bernstein (1994), however, accepted a more lenient criterion when they stated that "*in the early stages of predictive or construct validation research, time and energy can be saved using instruments that have only modest reliability, e.g. 0.70*" (pp. 264-265). They also state that "*It can be argued that increasing reliabilities much beyond 0.80 in basic research is often wasteful of time and money*" (p. 265).

Looking first at the reliability estimates, it can be seen that all scales had α values above 0.70 and were therefore considered to be reliable (Nunnally and Bernstein, 1994). Evidence of internal consistency and factorial validity supports the use of these scales in further analysis. Means and standard deviations for each of the scales are also reported in Table 3. The means were formed by adding the individual items in each scale and then dividing by the number of items in the scale. This technique allows easy comparison between scales because it places them on a common metric where the maximum possible score was 7.0 and the minimum possible score was 1.0.

The means scores of the scales comprising CBIS Importance indicate that some functions were more important than others. The highest score was obtained for accounting functions with a mean just above the midpoint of the scale ($\underline{M}$ = 4.30). Mean scores for Small-Office-Home-Office (SOHO) applications ($\underline{M}$ = 2.81) and management software ($\underline{M}$ = 1.16) were much lower, suggesting that these latter functions are unimportant. Paired t-tests indicated that the difference between Accounts and SOHO was significant ($\underline{t}$, [168] = 8.97, $\underline{p}$ < .01), as was the difference between Accounts and Management ($\underline{t}$, [168] = 221.75, $\underline{p}$ < .01), and SOHO and Management ($\underline{t}$, [168] = 12.11, $\underline{p}$ < .01).

The mean scores of the scales measuring Decision-Making indicated that *Operational Reasons* ($\underline{M}$ = 5.63) for choosing to implement a CBIS were more important than *Strategic Reasons* ($\underline{M}$ = 4.33). A paired t-test confirmed that this difference was significant ($\underline{t}$, [168] = 12.076, $\underline{p}$<.01), but the fact that scores on both scales were above the midpoint (4.0) suggests that most small businesses chose to implement ISs for both operational and strategic reasons.

The alpha coefficients are shown in Table 3 below along with descriptive statistics for each of the scales.

Table 3: Descriptive Statistics for All Scales

Scale (n = 169)	No. of Items	Mean	Std. Dev.	α
CBIS Importance				
Importance of Accounts	6	4.30	1.79	0.78
Importance of SOHO	4	2.81	1.63	0.73
Importance of Management Software	3	1.16	1.53	0.78
Organisation Characteristics				
Competitiveness	3	4.92	1.59	0.85
Expansion & Growth	5	5.08	1.14	0.85
CBIS Technical Capacity	8	4.04	1.36	0.94
Decision Making				
Operational Reasons	6	5.63	1.00	0.85
Strategic Reasons	6	4.33	1.55	0.87
Decision Criteria				
Decision Criteria	22	3.84	1.04	0.89
CEO Characteristics				
CEO Innovativeness	3	4.63	1.29	0.87
CEO CBIS Knowledge	3	4.06	1.36	0.93
Cost Benefit Analysis Techniques				
Cost Benefit Techniques	8	2.03	1.41	0.91

The three scales measuring Organisational Characteristics also received ratings that placed them either just above (Competitiveness: $\underline{M}$ = 4.92 and Expansion and Growth: $\underline{M}$ = 5.08) or right at the midpoint of the scale (CBIS Technical Capacity ($\underline{M}$ = 4.08). There was no difference between the ratings for the first two of these scales, but a significant difference did emerge between both of these and CBIS Technical Capacity ($\underline{t}$, [168] = 5.85, $\underline{p}$<.01 and $\underline{t}$, [168] = 11.36, $\underline{p}$<.01 respectively). These findings indicate that whilst businesses see themselves as being innovative and expanding, they do not rate their technical capacity quite as highly.

Decision Criteria was a scale made up of many items assessing the sources of information used when making purchase decisions. A high score can be interpreted as a tendency to consult a wider range of sources and to attach high importance to these sources. The mean score was 3.84, just below the midpoint of the scale. When one considers that many sources were covered by the 22 items, an overall mean that is close to the midpoint indicates that a reasonable amount of market research went into the purchases. This interpretation can be better illustrated by displaying the means for the various items (plus two items discarded from the scale during EFA due to low communalities). This information is presented in Table 4.

It can be seen from Table 4 that the most important decision criteria were those to do with system support, price, and confidence in the vendor. This group of items all had means greater than 5 indicating they were the most important consideration in small business' deliberations about which CBIS to purchase. It seems that very little notice was taken of advice from others, in particular employees, consultants and family members. However, opinions and recommendations from users was important to the decision making process. The importance of advice from similar businesses was only just below the scale mid point indicating this criterion is also important to the decision making process.

Table 4: Descriptive Statistics for Items Measuring Decision Criteria

Items (n = 169)	Mean	Std. Deviation
Purchase Price **	5.62	1.45
After sales support from the vendor	5.61	1.80
Installation support	5.36	1.67
Pre-purchase information and support from the vendor	5.33	1.74
Ability to adapt the system to your specific needs	5.28	1.70
Confidence in the vendor	4.83	1.85
Design of reports and screens	4.72	1.70
Response speeds of the system	4.51	1.96
Recommendations from users	4.44	2.00
Software updates	4.34	2.08
Manuals and documentation	4.22	1.90
Availability of training	4.02	2.10
Advice from a similar business	3.96	2.24
Existing skills of operators in your organisation	3.77	2.03
Advice from an accountant or financial advisor	3.34	2.14
Finance and purchase options	3.07	2.07
Ergonomic design and appearance of the hardware	2.95	1.75
Delivery lead times	2.95	1.96
Promotional and marketing brochures	2.66	1.63
Advice from in-house employees	2.62	1.98
Advice from external consultants	2.42	1.98
Advice from family members **	2.35	1.77
Advertisements in magazines and papers	2.14	1.54
Information in computer magazines	1.88	1.52

Note: The two items marked with double asterisks were eliminated from the scale following the factor analysis because of low communality, leaving 22 items in total.

In total, 12 of the *Decision Criteria* items had means greater than 4 (the scale mid point). This level of means indicated that small business considers a range of criteria during the acquisition of their CBISs and that market research is an important part of their deliberations.

Turning to the CEO Characteristics section, means for both the *CEO Innovativeness* (M = 4.63) and *CEO CBIS Knowledge* (M = 4.06) scales were above the midpoint with the *CEO Innovativeness* dimension rated more important than *CEO CBIS Knowledge* (t, [168] = 5.42, $p<.01$). This finding suggests that managers rate themselves as resourceful and innovative, and knowledgeable about CBIS, but with more of the former quality than the latter.

Finally, the low mean for *Cost Benefit Techniques* (M = 2.03) suggests that very little attention was paid to the use of formal cost-benefit techniques when determining which CBIS to implement. While there is considerable emphasis on market research, it would appear that most small business have not adopted formal decision evaluation processes in the form of recognised cost benefit analysis techniques. This situation could be a result of the availability of recognisable pre-packaged application and software products or could point to small business' lack of knowledge concerning cost benefit analysis and the application of formal decision evaluation techniques.

Group Differences on Scales

As part of the final analysis of the scales, checks also were carried out to ascertain whether the descriptive statistics shown above were characteristic of the whole sample or whether there were differences among sections of the sample. Differences on such variables as size of company would limit the generalisability of the findings. Information that could be used to classify the company into different types was collected in the demographic items of the survey instrument and consisted primarily of questions designed to assess the age of the company and its experience with computer technology. The relevant items are shown in Table 5.

Table 5: Demographic Items Considered in the Correlation Analysis

Demographic Item Name	**Survey Item**
Total Staff	1.1 How many people does your business employ, including the proprietor(s)?
Years Established	1.2 What year was the business established?
Years Current Owner	1.3 If not the original owner, what year did the current owner takeover the business?
Years 1st CBIS	1.4 When did your business start using its first computer-based information system?
Years Current CBIS	1.5 When did your business start using its current computer-based information system?

All of these items yielded continuous data so Pearson product-moment coefficients were suitable for determining whether relations existed between individual items and any of the scales discussed above. Using an alpha level of .001 to compensate for the fact that there were many correlations to be checked and that the analyses involved individual items (which are less reliable than aggregates of items, i.e., scales), *Total Staff* was significantly correlated with *Importance of Accounts* (.40), *Importance of Management Applications* (.47), *Organisation Technical Capacity* (.27), and *Decision Criteria* (.30). Thus, the larger organisations tended to do more market research, to have better technical capacity, and to have a greater need for accounting software and management applications. These findings are in accordance with expectations. It should be noted, however, that the effect of size is small in each case, not amounting to more than 22% of shared variance.

There were no other significant (p < .01) relationships between the scales derived from the exploratory factor analysis and items designed to collect demographic information.

Conclusion

The two sets of outcomes reported in this paper are of importance to researchers examining the success of IS in small business. Firstly, the determination of scales derived via the EFA has successfully determined sets of items that underlie key variables that appear to be related to the prediction of IS success in small business. This gives researchers a way forward in examining small business characteristics but also provides the businesses themselves with a set of items that could be used as a precursor for self determination of the likelihood of them implementing IS into their firm's operations. Secondly, the relationships among the scales and their relationships to demographic characteristics shows issues that are going to be difficult to confront. For example, larger firms, or those with more resources, are more likely to undertake more in-depth research and have greater technical capacity. It is difficult to advise very small and micro-business that their main difficulties arise because they don't employ enough people or don't spend enough time on market research.

The limitations of the study should also be noted as they affect the generalisability of the study and extrapolation of the findings to a broader business population. The two key limitations are the small sample size, only businesses that indicated they were willing to participate were surveyed, and all the businesses operate in regional Australia.

Notwithstanding the limitations of the study the factors determined from the analysis use scales that other researchers can confidently use in future research and correspond to the findings of prior research. The determination of these scales makes an important contribution to research in developing the antecedent factors that determine IS success in small business. In future analyses the authors will model the relationships among these scales and their role in determining IS success using Structural Equation Modeling (SEM).

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